Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/314
USSR
February 1964
Original: RUSSIAN

Confidential until official release during Conference

Abstract

SOME OPERATIONAL RESULTS OF FIRST POWER STATION AS EXPERIMENTAL SET - UP

Ushakov G.N. et al

Designing of new nuclear power plants and in the first place Belojarskaja atomic power station raised a number of problems required the development of special experiments such as: carrying out water-boiling and steam superheating operating conditions in tube fuel elements, studying conditions of formation, accumulation and release of radiolytic O_2 and H_2 and graphite and steel behaviour in pile.

I. The primary problem of new plant construction is the experimental development of fuel elements. This problem required the establishment of various experimental loops at the first atomic power station:

1) two-contour steam-superheat loop,
2) natural-circulation water loop,
3) water-unit for chemical experiments,
4) high-pressure water unit,
5) high-melting organic coolant loop,
6) low-melting organic coolant loop.

2. High-temperature coolant and large power density in fuel elements resulted in high temperature of graphite core. Commercial N_2 is used for graphite core filling. Contents of O_2, H_2 and CO_2 is maintained by I%.

The feasibility of long-lived graphite core operation up to 700 - 800°C is confirmed by ten years successful work. The measurements of physical and mechanical properties of irradiated technological channel graphite blocks were made. Graphite core operational conditions were observed to be sa-

Translation provided by courtesy of the submitting Government

tisfactorily after ten years work. Irradiated and nonirradiated graphite behaviour in N_2, and N_2, H_2O environment was studied in the range of 700, 900, I000 and II50°C temperatures.

3. The channel and fuel element design was subjected to long time exposure to neutron radiation and high heat flux being rather stable during steady-state and transient operation of atomic power station. The tube fuel element channel design is versatile and permits channel to operate under boiling and steam-superheating. No getting fissian products is possible into the primary contour in the above mentioned design even under the failure. Experiments resulted in the definition of allowable burn-up U^{235} were conducted. In some channels the lifetime fuel exposure up to 30-32 kg/1tonn was reached within 44000 hours.

4. New raised problems of experimental channel testing put a question about some reconstruction of reactor and its system. Circular system reconstruction of the first contour was accomplished in I963. Pumps with hydrolic shaft seals were replaced by cenned rotor ones. To extend experimental possibilities the diameter increasing in some charge holes of graphite core up to 95 - I20 mm was supposed.

5. The results of investigation of water and superheated steam radiolysis and also superheated steam radioactive impurities deposition on turbine vane models are discussed. This work was carried out on the loop simulating Belojarskaja atomic power station schemes. It was determined that radiolitical gas yield strongly depends on O_2 dissolved in water. Deposition radioactivity on turbine vane models was I0% initial in a month after shut-down. In depositions were found out Cr-5I, Fe-59, Ca-60, Ni-58, Ca-45.

Radioactive depositions are chemical stable compounds wnich are not affected by water and steam.